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Emissions Monitoring System for the OU 7-10 Glovebox Excavator Method Project

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B. E. Johnson	R	7-22-02	I&C Design Author
D. R. Norman	R	7/22/02	I&C Design Author
G. L. Makey	R	7-22-02	I&C Design Checker
T. M. Hipp	R	7/22/02	I&C Design Lead
K. L. Shropshire	A	7/23/02	Project Engineer
11. Document Control Release Signature: Juana Cruz	A	8/01/02	ER DMCS

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1. SCOPE

1.1 General

This procurement specification describes a stack monitoring system that will be purchased for the monitoring of particulate radioactive material releases from the Operational Unit 7-10 Glovebox Excavation Method Project at the Idaho National Engineering and Environmental Laboratory (INEEL). The term supplier refers to the company or organization responsible for the fabrication and delivery of the monitoring system. The term purchaser refers to Bechtel BWXT Idaho, LLC. The term system refers hereafter to all of the equipment provided by the supplier. This specification covers the requirements of the system.

1.2 Work and Parts Included

The supplier must provide all necessary designs, analysis, drawings, shop fabrication, testing, quality assurance, cleaning, documentation, and packaging to deliver the operational system. Detailed design requirements for this section will be provided in Section 5 of this document.

1.2.1 Major Components

The major components of the operational system are:

- Weatherproof climate-controlled monitoring cabinet to house the flow control, sampling, and monitoring equipment/instruments
- Sample pumps and flow control system
- Eberline Alpha-7 continuous air monitor
- Data recorder/logger.

1.2.2 Shrouded Probes and Sensors

Three shrouded probes with an inside tube diameter of 1.25 in. made from stainless steel tubing shall be provided with the dimensions as listed in Section 5. Also included shall be the necessary sensors (total pressure, static pressure, and temperature) to determine actual volume released to support a representative sampling system.

1.2.3 Sample Tubing and Instrument Lines

All necessary materials to connect the probes and sensors to the stack-monitoring cabinet shall be provided. This includes sample lines, heat

trace, insulation, sensor tubing, and electrical connections from the stack-monitoring cabinet for the heat trace and sensors. Others will provide supports for the sample tubing and instrument lines.

1.2.4 Miscellaneous Equipment

All support cables, connectors, equipment, sources, and computer programs to support calibration and configuration of the stack-monitoring system shall be included.

1.2.5 Onsite Support

Technical installation support and startup shall be provided to ensure that the completed system conforms to the requirements of this specification.

1.3 Work and Parts Not Included

Equipment and personnel to physically install the monitoring cabinet, sample and instrument lines, and probes will be provided.

2. QUALIFICATIONS

2.1 Manufacturer Qualifications

2.1.1 Testing

The supplier must be able, at their manufacturing facility or at a facility owned by them, to demonstrate the operation of the system, including, but not limited to, performing a system calibration using radiation sources.

2.1.2 Drawings

The supplier shall be able to provide detailed drawings showing a stack-monitoring system that meets the requirements of the specification. Drawing format shall be Autocad 2000 compatible.

2.1.3 Referrals

The supplier shall be able to provide referrals to companies and locations where the equipment they are proposing has been or is being used.

2.1.4 Cost

A ceiling price for this specification is $150,000.

3. APPLICABLE CODES, STANDARDS, AND REFERENCES

3.1 Standards

A. ANSI/HPS N13.1-1999, "Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities."

B. 40 CFR 61, "National Emission Standard for Hazardous Air Pollutants," Subpart H, "National Emissions of Radionuclides Other Than Radon from Department of Energy Facilities."

C. ANSI N42.18, "Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents."

D. ANSI N323a, "Radiation Protection Instrumentation Test/Calibration."

E. NFPA 70, "National Electrical Code."

F. 29 CFR 1910, "Occupational Safety and Health Standards."

4. SUBMITTALS

4.1 General

Submittals required by the supplier are set forth in Form 431.14, which is attached. Submittals may be combined (for example a spare parts list could be in an operating manual). In this case, the supplier shall identify the particular submittal and its location (document and page number).

4.2 Spare Parts

The supplier shall provide a list of recommended spare parts for operating the system for a period of 1 year with a maximum mean time to repair of 4 hours. The list shall include the name of the manufacturer and the manufacturer's part number and the supplier's part number as well as whether the parts are available from sources besides the supplier. The information is required with shipment of the system.

4.3 Drawings

The supplier shall submit detailed shop drawings for approval. Shop drawings shall show cabinet size and layout, with all components and interfaces identified. Wiring diagrams, circuit schematics, and a system piping and instrumentation diagram shall also be provided. Shop drawings shall be submitted for approval within 4 weeks after the award of the contract and prior to fabrication.

4.4 Operation and Maintenance Manuals

The supplier shall provide four complete sets of operating, maintenance, and installation manuals. The maintenance manuals shall contain circuit schematics, logic diagrams, elementary wiring diagrams, mechanical and electrical assembly details, software flow charts, parts lists, and recommended calibration and preventive maintenance procedures. The drawings shall be complete and accurate with respect to the system supplied. If blocks or squares are used to indicate a portion of the circuit or assembly, a complete drawing depicting the contents of the block or square must be presented elsewhere in the manual. All individual components shall be identified on the schematic drawings and on the parts list. Parts lists shall identify the original equipment manufacturer and list the original equipment manufacturer's part numbers and the supplier's part numbers. The manuals are required with the shipment.

4.5 Calibration Certificates

Calibration certificates on all individual instruments, as applicable, and on the system end-to-end shall be provided (certificates shall identify the instrument by model and serial number, the person doing the calibration, the standard used, and list at least three points with inputs and as-left output values). End to end refers to the complete system, from detector to readout and outputs from the transmitter. The certificates are required with the shipment.

4.6 Software

A personal computer readable copy of all operating software shall be provided for future reference and for modification, if required. The copy of the software shall be provided as a standard format (e.g., 3.5-in. floppy diskettes or CD) and as paper hard copy. The purchaser reserves the right to modify the software as necessary or to use a subcontractor to modify the software.

4.7 Factory Acceptance Test

The supplier shall submit a Factory Acceptance Test (FAT) procedure that will be used in the testing of equipment prior to shipment. The purchaser must approve this procedure prior to the start of FAT. At least 20 days prior to the start of the FAT, a copy of the test procedure shall be submitted to the purchaser for approval. The purchaser reserves the right to witness the FAT at the supplier's facility. Within 2 weeks after completion of the factory operational test, the supplier shall submit a written test report for approval by the purchaser prior to shipment. The test shall verify, as a minimum, the following:

- Flow control over the range of operation

- Operation of strip-chart recorder/data logger
- Operation of all alarm relays, including the alpha monitor alarm, which must be activated by an alpha source
- Calibration requirements per Section 4.5.

5. DESIGN AND PERFORMANCE REQUIREMENTS

5.1 General

The system shall consist of a complete monitoring system the details of which are listed in this section. The balance of this specification contains salient features necessary to enable a supplier to offer an acceptable system.

5.2 Design Requirements

5.2.1 Stack Monitoring Cabinet—General

5.2.1.1 Cabinet will be a Hoffman A-74H72JULP or approved substitute.

5.2.1.2 Environmental controls for the cabinet will include heating and air conditioning to maintain temperatures inside the cabinet between 65 and 90°F for outside temperatures of -30 to 120°F. There will be no outside air that is circulated through the cabinet to control the temperature of the cabinet.

5.2.1.3 The cabinet will be designed to mount to a concrete pad at the base of the exhaust stack.

5.2.2 Stack Monitoring Cabinet—Instruments

5.2.2.1 Instruments shall be labeled per Instrument Society of America 5.1

5.2.2.2 One Eberline Alpha-7 continuous air monitor shall be provided, which will be connected to a 1.25-in. ID sample line. The connection to the Alpha-7 will be with a Swagelok® connector.

5.2.2.3 The cabinet will contain a 47-mm filter holder with the ID from the 1.25-in. tubing for the sample of the record.

5.2.2.4 A flow measurement device shall be provided that calculates stack flow from the two pressures provided.

5.2.2.5 A datalogger shall be provided that continuously logs the analog signals identified in Section 5.2.6. Logging shall be on a 10-second interval; the datalogger must have the capability to store at least 1 month's worth of data in its internal memory. A serial port (or similar means) and any necessary software shall be provided to allow retrieval of data from the datalogger with a laptop computer. The datalogger shall also have a digital display capable of displaying the logged parameters in real time.

5.2.3 Stack Monitoring Cabinet—Flow Control System

5.2.3.1 The cabinet will house a flow control and monitoring system with interfaces to the Idaho National Engineering and Environmental Laboratory (INEEL) Operable Unit 7-10 Glovebox Excavator Method Project's equipment and systems.

5.2.3.2 The motor that provides the flow shall have a backup that is automatically started if the primary pump fails.

5.2.3.3 Flow control logic and circuitry.

5.2.3.4 All flow calibration isolations and connections. (Calibration equipment will also be supplied.)

5.2.3.5 The sample flow will be proportional to the stack flow. For a nominal stack flow of 6,361 actual cubic feet per minute (ACFM), the sample flow will be 1.5 ACFM.

5.2.3.6 The stack monitoring system will be able to operate with only one sample, if necessary, having the spare sample lines valved out when not in operation.

5.2.4 Stack Monitoring Cabinet—Wiring

5.2.4.1 There will be no exposed electrical voltages of 50 volts or greater in the cabinet.

5.2.4.2 All switches, terminal strips connectors, and components shall be clearly labeled.

5.2.4.3 One side of each terminal strip requiring external field wiring shall be reserved for field wiring.

5.2.5 Stack Monitoring Cabinet—Power

5.2.5.1 Power will be provided by one 30-A/208 Variance at Completion (VAC) circuit (by others).

5.2.5.2 The cabinet will be provided with a Safety Disconnect switch on the outside right hand side of the cabinet where the 30-A/208 VAC will be connected.

5.2.5.3 The cabinet will contain four receptacles, which will provide 120-VAC power to the continuous air monitor (CAM) and data recorder. The combined expected load for these circuits is less than 1.2 kVA (alpha CAM 2 amps, strip chart recorder 2 amps, spare CAM 2 amps, 4 amps misc.).

5.2.6 Stack Monitoring Cabinet—Analog Outputs

5.2.6.1 The stack monitoring system will provide the following analog output connections via terminals:

Terminal Block #2 (Analog Outputs)	
Terminal	Description
1	+ Stack Flow
2	- Stack Flow
3	+ Sample of Record Flow
4	- Sample of Record Flow
5	+ Sample Flow Alpha CAM
6	- Sample Flow Alpha CAM
7	+ Sample Flow Spare
8	- Sample Flow Spare
9	+ Alpha CAM Output
10	- Alpha CAM Output
11	+ Stack Air Temperature
12	- Stack Air Temperature
13	+ Barometric Pressure
14	- Barometric Pressure

5.2.6.2 Analog accuracy shall be within +/-10 % of the actual indicated value unless otherwise indicated.

5.2.6.3 Analog outputs shall have a range of 4–20 mA and shall be passive element (external excitation), two-wire devices.

5.2.7 Stack Monitoring Cabinet—Digital Outputs

5.2.7.1 The cabinet shall be provided with the following digital outputs:

Terminal Block #3 (Digital Outputs)	
Terminal	Description
1	Low Stack Flow
2	Low Stack Flow
3	Low Sample of Record Flow
4	Low Sample of Record Flow
5	Low Alpha CAM Flow
6	Low Alpha CAM Flow
7	Low Sample Flow (Spare)
8	Low Sample Flow (Spare)
9	High Alpha Activity
10	High Alpha Activity
11	Spare 1
12	Spare 1
13	Spare 2
14	Spare 2
15	Spare 3
16	Spare 3

5.2.7.2 Digital outputs shall be dry contact type and rated for 120-V 10-Adc. Contacts shall be normally closed, open on alarm.

5.2.8 Sample Lines

5.2.8.1 Sample lines will be constructed of 1.25-in. stainless steel tubing.

5.2.8.2 The sample lines will be heat-traced and insulated to maintain a temperature of at least 90°F on the sample lines. Indication shall be provided for the heat trace to indicate whether it is operational or not.

5.2.9 Sample Probes

5.2.9.1 The samples probes will be constructed to the following dimensions, centerline of 1.25-in. tubing (please refer to attached drawings for additional information):

5.2.9.1.1 First sample nozzle will be 29 in. from the sample-shrouded probe to the center of the 90° bend going out of the stack, then 36 in. from the center of the 90° in the stack to the end of the sample nozzle outside of the stack.

5.2.9.1.2 Second sample nozzle will be 32.5 in. from the sample-shrouded probe to the center of the 90° bend going out of the stack, then 36 in. from the center of the 90° in the stack to the end of the sample nozzle outside of the stack.

5.2.9.1.3 Third sample nozzle will be 36 in. from the sample-shrouded probe to the center of the 90° bend going out of the stack, then 36 in. from the center of the 90° in the stack to the end of the sample nozzle outside of the stack.

5.2.10 Other

5.2.10.1 The supplier shall provide all special equipment, such as tools, connectors, and adapters, required to perform routine maintenance and calibration of the system with the system.

5.2.10.2 Indicators shall be installed on the front of the system cabinet to indicate operational state (normal, pump failure, etc.) and alarm conditions. Alarm conditions shall be those specified in Section 5.2.7.1.

5.2.10.3 All welding equipment, filler metal, procedures, and workmanship shall be in accordance with the American Welding Society (AWS) D1.6. All welding shall be performed by welders or operators qualified in accordance with AWS D1.6. Sufficient slag and weld splatter shall be

removed to allow visual examination. Examination, inspection, and acceptance criteria shall be per AWS D1.6.

5.3 Performance Requirements

5.3.1 Environmental Conditions

5.3.1.1 The system will be operated outside. The normal external environments are pressure atmospheric at 5,000 ft (pressure range from 24 to 26 inHg), temperature -50 to -140ºF, humidity 0–99%, and 1 mrad/h background radiation level.

5.3.1.2 Seismic design shall conform to the UBC-1997. Use seismic 2B-soil profile SD and importance factor 1.25.

5.3.2 Operational Conditions

5.3.2.1 System shall support stack flows from 2,000 to 8,000 ACFM.

5.3.2.2 System shall have a design life of at least 10 years.

5.3.2.3 System shall operate over stack gas temperatures of 50 to 120°F.

5.3.2.4 Alpha monitor shall be calibrated to detect and alarm on at least Pu-239 and Am-241.

5.3.2.5 Set-point adjustment shall require a password or key switch.

5.3.2.6 The system shall be capable of being calibrated end-to-end with National Institute for Standards and Technology tractability.

5.3.2.7 The system shall have alarm set-point accuracy within +/- 10% of the actual reading.

5.3.3 Reliability

5.3.3.1 Mean time between failures must be 35,000 hours or greater.

5.3.3.2 Mean time to repair system must be 4 hours or less.

6. QUALITY ASSURANCE

6.1 General

The supplier shall have a quality assurance program to ensure the above requirements are met. The purchaser, at the supplier's facility or at the INEEL, will inspect general workmanship and operation and the supplier will correct unacceptable workmanship.

6.2 Factory Acceptance Test

The supplier shall furnish all test and auxiliary equipment (including cables and connectors) necessary to perform the factory operations test. The supplier shall give the purchaser at least 2 weeks notification prior to testing. The purchaser reserves the option to witness all testing.

7. PACKAGING AND SHIPPING

All items shall be prepared and packed such as to protect them from damage and weather exposure while in transit. The package shall be constructed to ensure acceptance by common or other carrier at the lowest rate for safe transportation to the terminal point of delivery. Provision shall be made to protect all surfaces during shipping and subsequent handling and storage at the job site.

8. REFERENCES

ANSI/HPS N13.1-1999, 1999, "Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities," American National Standards Institute/Health Physics Society.

ANSI N42.18, 1980, "Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents," American National Standards Institute.

ANSI N323a, 1997, "Radiation Protection Instrumentation Test/Calibration," American National Standards Institute.

29 CFR 1910, February 2002, "Occupational Safety and Health Standards," *Code of Federal Regulations*, Office of the Federal Register.

40 CFR 61, Subpart H, March 2002, "National Emissions of Radionuclides Other Than Radon from Department of Energy Facilities," *Code of Federal Regulations*, Office of the Federal Register.

NFPA 70, August 2, 2001, "National Electric Code," National Fire Protection Association.